

CLAIMS

What Is Claimed Is:

1. A power transfer assembly for use in a motor vehicle having a powertrain and first and second drivelines comprising:
  - a first output shaft adapted to transmit drive torque from the powertrain to the first driveline;
  - a second output shaft adapted to transmit drive torque to the second driveline; and
  - a torque transfer mechanism for transferring drive torque from said first output shaft to said second output shaft, said torque transfer mechanism including a first gearset operably interconnecting said first output shaft to said second output shaft, a second gearset having a worm meshed with a worm gear fixed for rotation with a component of said first gearset, and an electric motor driving said worm, wherein said worm gear has less than twenty-four teeth.

2. A transfer case for use in a four-wheel drive vehicle having a powertrain and first and second drivelines, comprising:

a first output shaft adapted to transmit drive torque from the powertrain to the first driveline;

a second output shaft adapted to transmit drive torque to the second driveline;

a differential unit having a first gear driven by said first output shaft, a second gear driving said second output shaft, a third gear meshed with said first and second gears, and a carrier rotatably supporting said third gear;

a worm gearset having a worm gear fixed for rotation with said carrier, and a worm meshed with said worm gear; and

a motor operable for driving said worm, wherein a locked four-wheel drive mode is established when said worm gearset is held against rotation, and an on-demand four-wheel drive mode is established for varying the drive torque transferred from said first output shaft to said second output shaft when said motor is actuated to vary the rotary speed of said carrier relative to said first output shaft.

3. The transfer case of Claim 2 wherein said third gear has a first gear segment meshed with said first gear and a second gear segment meshed with said second gear.

4. The transfer case of Claim 2 wherein said worm gearset is self-locking such that said carrier is held against rotation until said worm gearset is rotatably driven by said motor.

5. The transfer case of Claim 2 further comprising:  
sensors for sensing operational characteristics of the motor vehicle; and  
a controller for controlling variable actuation of said motor in response to sensor signals from said sensors.

6. A transfer case for use in a four-wheel drive vehicle having a powertrain and first and second drivelines, comprising:

a first output shaft adapted to transmit drive torque from the powertrain to the first driveline;

a second output shaft adapted to transmit drive torque to the second driveline;

a bevel differential unit having a first side gear driven by said first output shaft, a second side gear driving said second output shaft, pinion gears meshed with said first and second side gears, and carrier rotatably supporting said pinion gears;

a worm gearset having a worm gear fixed for rotation with said carrier and a worm meshed with said worm gear; and

a motor operable to drive said worm, wherein a locked four-wheel drive mode is established when said worm gearset is held against rotation, and wherein an on-demand four-wheel drive mode is established when said motor is actuated to vary the rotary speed of said carrier relative to said first output shaft.

7. The transfer case of Claim 6 wherein said worm gearset is self-locking such that said carrier is held against rotation until said worm gearset is rotatably driven by said motor.

8. The transfer case of Claim 6 further comprising:

sensors for sensing operational characteristics of the motor vehicle;

a controller for controlling variable actuation of said motor in response to sensor signals from said sensors; and

a mode selector for permitting selection of said locked four-wheel drive mode and said on-demand four-wheel drive mode, said mode selector operable for sending a mode signal indicative of the specific drive mode selected to said controller, whereby said motor is non-actuated and said worm gearset is held stationary when said locked four-wheel drive mode is selected, and whereby said motor is variable actuated in response to said sensor signals to vary the rotary speed of said carrier relative to said first output shaft for continuously varying the torque transmitted to said second output shaft when said on-demand four-wheel drive mode is selected.

9. A transfer case for use in a four-wheel drive vehicle having a powertrain and first and second drivelines, comprising:

a first output shaft adapted to transmit drive torque from the powertrain to the first driveline;

a second output shaft adapted to transmit drive torque to the second driveline;

a geared differential unit having a first gear driven by said first output shaft, a second gear driving said second output shaft, a third gear meshed with said first and second gears, and a carrier rotatably supporting said third gear;

a worm gearset having a worm that is meshed with an enveloping worm gear fixed for rotation with said carrier, said worm gear having less than twenty-four teeth; and

a motor operable for driving said worm.

10. The transfer case of Claim 9 further comprising a control system for controlling variable speed actuation of said motor to vary the relative speed between said first output shaft and said carrier for controlling the drive torque transmitted to said second output shaft.

11. The transfer case of Claim 10 wherein a locked four-wheel drive mode is established when said worm gearset is held against rotation, and wherein an on-demand four-wheel drive mode is established when said motor is actuated to vary the rotary speed of said carrier relative to said first output shaft.

12. The transfer case of Claim 9 wherein said worm gear is self-locking such that said carrier is held against rotation until said worm gearset is rotatably driven by said motor.

13. The transfer case of Claim 9 wherein said geared differential unit is a bevel gearset having a first side gear as said first, a second side gear as said second gear, and a pinion gear as said third gear.

14. The transfer case of Claim 9 wherein said geared differential unit is a planetary gearset having a first sun gear as said first gear, a second sun gear as said second gear, and a planet gear as said third gear.

15. A power transfer assembly for use in a four-wheel vehicle having a powertrain and a first and second drivelines, comprising:

a first output shaft adapted to transmit drive torque from the powertrain to the first driveline;

a second output shaft adapted to transmit drive torque to the second driveline;

a reduction unit having an input gear driven by said first output shaft, an output gear driving said second output shaft, a reaction gear meshed with said input gear and output gears, and a carrier rotatably supporting said reaction gear;

a self-locking worm gearset having a worm gear fixed for rotation with said carrier and a worm meshed with said worm gear; and

a motor operable for driving said worm to vary the relative speed between said first output shaft and said carrier for controlling the drive torque transmitted from said input gear to said output gear.

16. The power transfer assembly of Claim 15 wherein a locked four-wheel drive mode is established when said worm gearset is held against rotation, and wherein an on-demand four-wheel drive mode is established for continuously varying the torque transferred to said second output shaft when said motor is actuated to vary the rotary speed of said carrier relative to said first output shaft.



17. The power transfer assembly of Claim 15 wherein said worm gearset is self-locking such that said carrier is held against rotation until said worm is rotatably driven by said motor.

18. The power transfer assembly of Claim 15 wherein said worm gear is an enveloping worm gear having less than twenty-four teeth.